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THE LAWLER GROUP, LLC

GREGORY E. LAWLER
A. RICHARD METZGER JR
RUTH M. MILKMAN

1909 K STREET, NW
SUITE 820
WASHINGTON, D.C. 20006
PHONE (202) 777-7700
FACSIMILE (202) 777-7763

SANTE J. ESPOSITO
ROBERT L. FOOSE II
DANIEL N. SEGAL

July 2, 1999

VIA MESSENGER

Magalie Roman Salas, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: CC Docket No. 94-102
Ex Parte

Dear Ms. Salas:

On Monday, June 28, 1999, Walter Bell, Vice President of Engineering of SnapTrack, Inc., participated in OET's Technical Forum regarding E911 technologies. The attached materials were presented by Mr. Bell at the Forum.

Two copies of this document are enclosed for filing. Please contact me if you have any questions in regard to this matter.

Sincerely yours,

Ruth Milkman

SnapTrack, Inc.

FCC Location Roundtable

Walter Bell

Vice President of Engineering

June 28, 1999

SnapTrack®

SnapTrack's Personal Location Technology

- Combine GPS receiving capability with a cell-based wireless network
  - Air interface independent
- Divide location determination task between client and server
- Extract key information from the wireless network
  - E.g., approximate location, carrier frequency
- Software-based solution
  - Use phone's own DSP chip to rapidly process an information-rich snapshot of GPS data using fast convolution software

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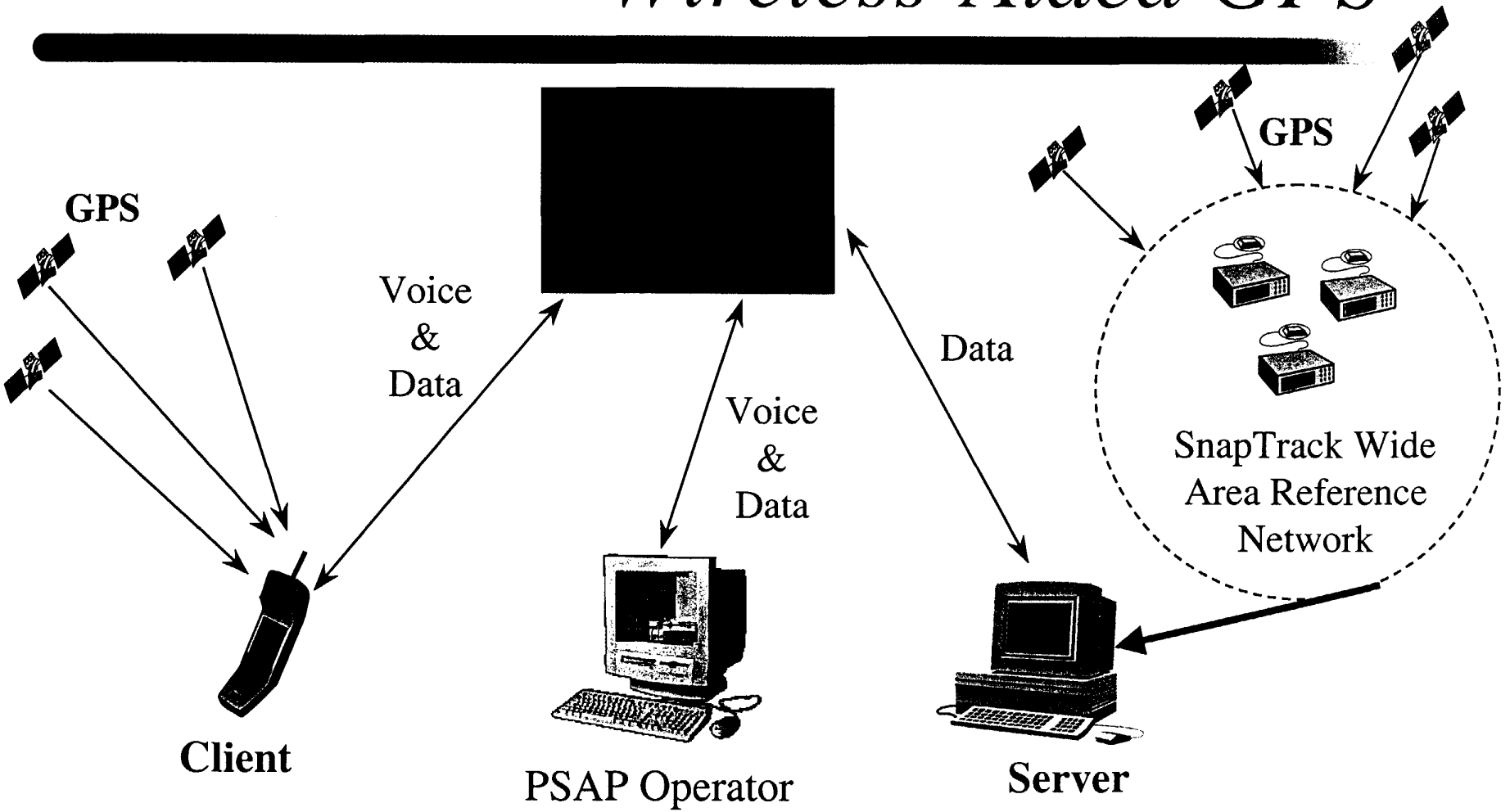
SnapTrack Wireless-Aided GPS



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Performance v. Conventional GPS

	SnapTrack	Conventional GPS
Accuracy	3-75 m	50-200 m
Time to first fix	seconds	up to 15 minutes
Acquisition yield	excellent	poor with any blockage
Power consumption	nominal	high
Cost to deploy	software-based ➔ minimal cost	hardware-based ➔ more expensive

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Comparison to Terrestrial Triangulation

SnapTrack Wireless-Assisted GPS

- Negligible network impact
  - air interface independent
  - server software can run on an existing platform
- Can achieve accurate fix with only a single base station as long as cell phone can communicate
  - first fix, cold start, 1-sigma accuracies generally range from 3-75 meters, depending on call environment
  - average accuracy of ≈20 meters
- Must use modified handsets

Terrestrial Triangulation

- Extensive network impact
  - modifications required to entire cellular network (new hardware and software at most if not all sites)
  - new receiver sites must be built to increase accuracy and coverage
  - accuracy dependent on cell configuration
  - requires at least 3-4 receivers in appropriate geometric pattern to provide accurate fix (unavailable in many environments)
- Severe multipath limitations

"Terrestrial triangulation systems are inevitably limited by multipath; wireless-assisted GPS is expected to achieve an order of magnitude better accuracy." - Lucent Technologies, TR 45 filing

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Test Groups

- Goals
  - Test and evaluate SnapTrack technology, serve as focus for standards activity
- SnapTrack CDMA test group
  - AirTouch, Ameritech, Bell Mobility, GTE, PrimeCo, Sprint PCS, U S WEST Wireless, Motorola, Samsung, LGIC, Hyundai, Denso, Fujitsu, Texas Instruments, VLSI
  - Wireless-assisted GPS messages being standardized in TR 45.5
    - Baseline text agreed, balloting scheduled for 8/99 completion
  - Audited tests have been conducted on two separate CDMA networks in Tampa, Florida (USA)
    - At 800 MHz (GTE Wireless) and 1900 MHz (Sprint PCS)
    - Prototypes from multiple handset vendors tested
- Recently launched SnapTrack GSM test group: 11 European and U.S. carriers

SnapTrack®

Major Field Tests

- United States
  - San Francisco Bay Area: analog (11/97)
  - Denver: analog/CDMA end-to-end E9-1-1 trial (8/98)*
  - Washington, D.C. : analog (11/98)
  - Tampa (SnapTrack CDMA Test Group): CDMA (3/99)
  - San Francisco (U.S. Marines Urban Warrior Exercise): GSM (4/99)
- Japan
  - Tokyo (NTT DoCoMo): PDC (12/97)
  - Kyoto (Manufacturer): PHS (2/98)
- Europe
  - Finland (Manufacturer): GSM (1/99)
  - Italy (Carrier): GSM (4/99)

* With Denver and Adams County PSAPs, SignalSoft, SCC, U S WEST Wireless

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Tampa CDMA Field Trial (1)

- Structured field test to validate SnapTrack GPS performance when operating in a CDMA network
  - Time and base station ID passed to GPS client in handset
  - Network carrier frequency used to calibrate GPS oscillator
- Prototype integration of SnapTrack GPS client with CDMA handset
  - 1st step in the GPS/handset commercialization process
  - Substantial hardware and software integration
  - Validated GPS performance within handset package
  - Measured performance with miniature antennas and head blockage

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Tampa CDMA Field Trial (2)

- SnapTrack server located on the wireless network
  - Used existing circuit switched wireless data service to communicate with the GPS client in the handset
  - Next field test will use standards based protocols for data connection, independent of the voice path
- All tests were independent, single, cold start fixes
  - Absolute worst case GPS scenario
  - Multi-fix averaging (3 - 5 fixes) can be applied to improve yield and precision in difficult environments
- Full range of environments: rural, urban, suburban, vehicles, indoor
  - 17 sites selected by wireless carriers to test operational limits

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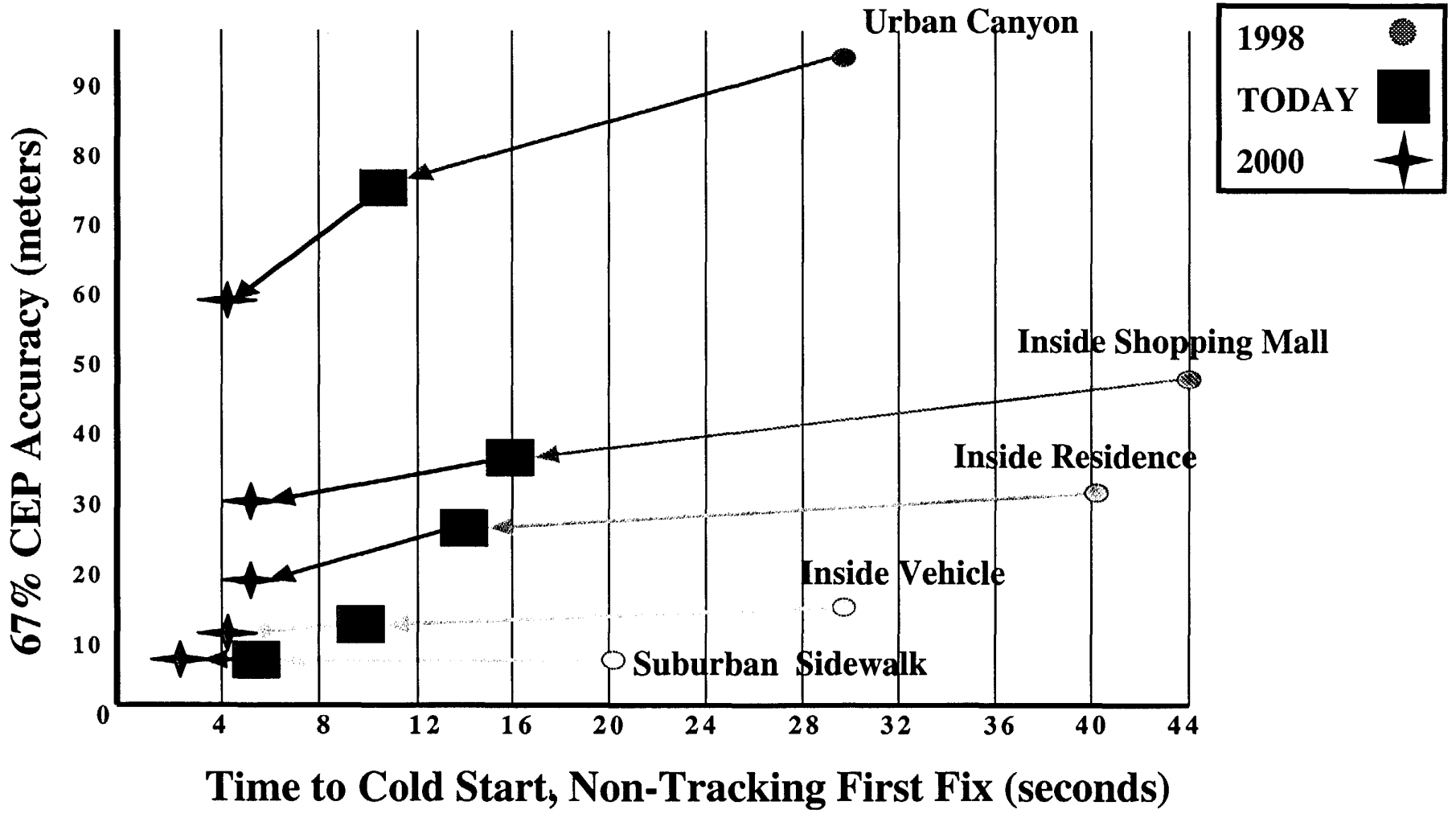
SnapTrack Technology Evolution Curve



Note: 2000 performance comes from faster DSP and further GPS algorithm improvements

SnapTrack®

Impact on Handset Cost

- SnapTrack's software based handset solution minimizes incremental manufacturing cost
  - Uses existing, standard processors already in handset
  - Many opportunities for sharing the few RF hardware components required
- Current estimates from semiconductor and handset manufactures are $7 - 10 incremental cost, including licensing fees, for first generation integrated implementations
  - Costs will drop sharply as semiconductor densities and levels of integration increase
- Use of standard processing elements will continually drive down cost, size and power consumption
  - Moore's law on transistor density (same cost and processing power trend seen in PCs)

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Commercial Agreements

- Motorola
  - equity investment and commercial license agreement
- Texas Instruments
  - equity investment and commercial license agreement
- NTT DoCoMo (Japan's largest wireless carrier)
  - commercial license agreement
- Denso (SnapTrack-enabled PDA)
  - commercial license agreement
- NEC (Japan server distribution)
  - commercial license agreement